Economic Valuation of the Environment

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Environment and Society: Concepts and Challenges

Introduction: economists aim to help the environment by pricing it

This chapter argues for and makes initial progress in undertaking a sociology of practices for valuing the environment. In particular, it offers a critical examination of the growth of economic valuations of environmental or ecological 'goods' and makes an assessment of key practical steps in attributing economic values to the environment. It argues that valuation and procedures for value attribution deserve to be considered a key concern within environmental social science. This chapter highlights the fact that, despite the significant growth of sociological studies of environmental topics over recent decades, not enough attention has been focused on the consequences of the ways in which economic conceptualisations and thinking have colonised the environmental sphere. Accordingly, attention is here directed at the way in which the environment has been made the subject for economic thinking, at some of the institutions that have grown up around this development, and at the practices of valuation that link everyday actions to economic pricing.

It is uncontroversial to suggest that the idea of interpreting and expressing environmental problems in economic terms began to be popularised around thirty years ago, and economic valuations of ecological issues have played a central role in environmental policy debates for nearly as long. But empirical and conceptual issues around the work of making economic valuations applicable to environmental entities have received relatively little attention within environmental sociology.[i]

Accordingly, this chapter commences with an exploration of the fundamental steps in economic valuations of the environment and of the rationale for their use. It moves on to review some recent ideas from science and technology studies, economic sociology and the social studies of finance which assist in understanding how markets are made and how economic logics are performed. Using examples from the cases of greenhouse-gas pricing and the valuation of ecosystem services, the chapter then analyses areas where the work of valuation is particularly contentious; it shows how social scientific insights are helpful in understanding the social processes by which valuations are arrived at. The chapter concludes by demonstrating how a case has been made for economic valuation to be recognised as a core concern for contemporary environmental social science.

Making the environment a subject for economic valuation

The core intellectual 'moves' in rendering environmental problems in economic terms are now relatively well known, but they can usefully be quickly summarised. One key principle is to interpret characteristic environmental harms as a form of 'negative externality', a cost or burden imposed on the public good through private actions. On this view, car drivers in urban areas are despoiling the air and thereby they are imposing 'costs' on people's health and wellbeing, affecting urban wildlife, and most likely damaging buildings. But the drivers are not paying the price for this harm since no environmental compensation costs are explicitly included in fuel prices or car taxation (and so on). Nor have drivers typically had to pay more to use their car where it causes most pollution.

To address this problem, economists proposed that environmental 'goods' are attributed with an economic value: that one thinks of clean air or fresh water as elements of natural capital and that one considers the good that aspects of the environment do for society as 'environmental services'.[ii] To the objection that the environment is not something that should be valued in economic terms, the counter-argument is that unless an economic value is attached to the environment it will be exploited and over-used. If the worth of clean urban air is expressed in financial terms, then the costs imposed on the city by drivers will be made apparent. Ways can then be found to re-allocate the price of environmental harms to drivers (through road-use permits for example or more sophisticated taxation schemes). This will lead drivers to use their cars less on urban roads and the environment will accordingly benefit.

A very similar logic can be applied to environmental resources: oil in the ground or fish in the sea and so on. Conventionally, these 'assets' are effectively priced only at the cost of extracting them. There is customarily no allowance for the decline in the value of the stock itself, even – in some cases – up to the point of exhaustion of the resource. Quite aside from the climate-change aspects of fossil fuels, the point is that in some obvious sense the world gets poorer as oil is used up (fish too if they are caught faster than they can breed), but this is not reflected in the price of oil-based products. In recent decades, fossil-fuel-based electricity has been cheaper to generate in many locations than most renewable kinds but the situation would in many locations have been reversed had the value of the decline in stocks been costed in to the price of coal or oil.

From the start, environmental economists anticipated objections to their approach. They were keen to point out that they were not trying to shrink the worth of natural riches by putting a money price on them. Instead they were saving the environment from the senseless over-use that was promoted precisely because environmental 'goods' were not priced in financial terms, because in an economic sense they were 'free'. These arguments have recently been endorsed in a

sociological context by Fairbrother (2016) who advocates that sociologists should adopt the term externality in the economists' sense.

In the UK, these arguments were popularised in a series of books associated with David Pearce (starting with Pearce et al 1989), a celebrated academic economist who was also adviser to the Secretary of State for the Environment under the Conservative government from 1989-1992. In interviews a colleague and I conducted in the UK finance ministry (the Treasury) in the early-mid 1990s, we found that the language of natural capital and even the definition of sustainable development as 'non-declining natural plus cultural capital' had already become widespread among civil servants (Forrester and Yearley 1995).[iii] At that time, the UK's leading environmental NGOs were hostile to or ambivalent about such approaches. But by 2013, the former Executive Director of Friends of the Earth in London (Tony Juniper) had authored a popular and successful book (2013, entitled *What Has Nature Ever Done for Us?*) which aims to show (according to the cover blurb) how 'nature provides the "natural services" that keep the economy going'.

These arguments now appear almost obvious and incontestable. Perhaps most famously, this kind of approach was applied to the issue of climate change in the internationally influential 'Stern Report'. Nicholas Stern (2007) used environmental economics to make climate change an issue for bankers, insurers and investors to take seriously. His celebrated assertion, often quoted from the Royal Economic Society public lecture of 2007, is that: 'The problem of climate change involves a fundamental failure of markets: those who damage others by emitting greenhouse gases generally do not pay … Climate change is a result of the greatest market failure the world has seen' (emphasis added). Though the exact economic basis of his calculations has been subject to a lot of technical criticism and debate, Stern's key argument was that thinking of climate change in financial terms allows one to see that the price of tackling climate change – however daunting it looks – is actually small and affordable compared with the costs of not acting.

Finally in this section, it is clear that this is not just a way to couch arguments about priorities and needs. It is not an academic or 'paper' exercise only. Environmental taxes, aimed at discouraging polluting activities, were already familiar in the 1980s; for example, lead-free petrol (gasoline) was taxed less than regular fuel to encourage motorists to adopt the less polluting alternative. For its part, the idea of pricing has been directly adopted in high-profile environmentally related policies. The first, well known and large-scale application was the approach to acid emissions from US power stations where permits to emit were created and traded. The total permitted amount across the whole sector was gradually reduced as permits were withdrawn year by year. Power stations that polluted less could afford to sell on their unneeded permits and thereby enhance their profits. By contrast, managers of the more polluting plant had to buy additional permits, adding to their costs and making

them poor performers in the commercial marketplace. The market in permits encouraged good environmental performance, while the poorly performing plant was marginalised and closed down. Environmental reforms were achieved through the market without the state (and constituency politicians) having to pick winners and losers. Moreover, this was achieved – in the economists' view – in an economically efficient manner: cleaner electricity was produced precisely in those plants where cleaning up was most cost-efficient. Thus the overall energy-generation system was reformed in an environmentally benign direction at something like the lowest possible cost using price signals rather than explicit policy mandates (see the detailed coverage in Ellerman et al 2000).

Similar arguments have been applied in the carbon dioxide emissions case. They underlay the nearly successful US 'cap and trade' climate policy of the first term of the Obama Presidency (known as the Waxman-Markey Bill, this legislation failed in 2010; see Skocpol 2013 and also Dunlap and Brulle 2015). These arguments also underpin the carbon markets that have come into existence around the world, though most notably in the EU. Finally, ecosystem services (such as the provision of clean water or pollination services) and the value of biodiversity have also increasingly come to be treated in this way. Policies for conservation are commonly expressed in terms of the value of the services supplied by habitats and species, and habitat conservation is frequently said to have an economic rationale.

Theorising valuation and the attribution of economic values

This trend towards economic valuation – and not only in the environmental realm – is so pronounced that there has not surprisingly been some sociological attention paid to it, and both analysts coming from within economic sociology and from science and technology studies (known as social studies of finance) have been influential. Aspects of the economics literature – as well as the response by ecological economists (see Spash 1999) – have also been important in promoting critical reflection on these moves.

A useful starting point for the present review is the now well-known pair of papers by Çalışkan and Callon (2009; 2010) that focuses on the issue of economising or 'economisation'. This is not economising in the sense of making savings, but the disruptive idea that economists typically approach their work on the assumption that a market or an economy already exists. These authors' point is that in many areas things have to be turned into an economy before the 'laws of economics' have a chance of applying to them. It is this process that they refer to as economisation. Such work on the making of 'economies' is not unprecedented of course; Mulkay and colleagues studied the rise of the discipline and practice of health economics in rather similar terms in the 1980s. Thus, Mulkay et al (1987) showed how techniques had to be institutionalised for comparing the burden of various diseases and

conditions so that economic approaches could subsequently be used to compare the cost of therapies against their typical benefits to patients. New practices for registering and comparing the harms done by worn hips or by diabetes had to be instituted before the average costs and benefits of various treatments could be assessed in economic terms. But Çalışkan and Callon helpfully build a general case for the dependence of economics on the social processes through which markets are made.

A further key contribution to this analytical programme was offered by MacKenzie who highlighted the performativity of economics, meaning by this the way in which economic ideas come into reality only as they are performed by economic actors. Economies are constituted by people and their actions, so that economic laws are performative in a way that, say, chemical laws are not. In particular, he emphasised what he calls 'Barnesian performativity' (2006, 21) where 'Practical use of an aspect of economics makes economic processes more like their depiction by economics' (2006, 17). MacKenzie's study is primarily about financial economics and the way in which theories about how to value derivatives (and other complex products) have come to shape actors' and institutions' responses to the developing market in just these products.[iv] People who believe that a theory prescribes the best way to act (in setting a price or in hedging investment risks) will tend to try to behave more and more in accordance with the theory; in some sense this will make the theory more descriptively accurate and more 'true'.

For his initial studies MacKenzie chose an area where the theory was complicated and actors had to put a lot of work into following its precepts. But one can also observe that environmental economics has a performative component to it. People come to view aspects of the environment increasingly in economic terms and then begin to treat environmental entities as economic instruments. For example, businesses develop that deal in carbon offsetting for flights or taxi trips and so on. Other actors can then trade in this offset carbon. Combining MacKenzie's idea with the approach of Çalışkan and Callon, one can observe that firms, or sub-divisions of existing firms, are set up to trade in carbon futures but this market needed to be constructed as an economic entity before their actions could conceivably take place. In these cases, there would be no scope for the economic activity without the institutions that the economic theory has underwritten. At the same time, the business of trading in carbon futures (say) reinforces the very idea of seeing climate change and excessive carbon emissions as something to be addressed through economic measures.

This focus on the development and imposition of an economic discourse onto environmental entities has also provoked reflection and critique by academics in disciplines close to economics. There is, for example, a tradition – about as old as 'modern' environmental economics – which refers to itself as ecological economics

(Spash 1999, 425-430). The distinctive emphasis here is on using ideas from the ecological and other sciences to try to pinpoint what is distinctive about ecological systems as compared with other objects that are made available through markets. The aim is to marry ecology and the other natural sciences with economics in order to have a quantitatively precise and scientifically accurate understanding of the dynamics of ecological systems. The fact that an early influential text (Georgescu-Roegen 1971) refers to thermodynamics and features the term 'entropy' in its title is indicative of the way in which ecological economists wished to emphasise the distinctiveness of environmental systems.

The operation of economic discourses of value has also been addressed by other sociologists, only loosely associated with the starting points of Callon or MacKenzie, who have begun to study the practical work of attributing value in organisational or accounting contexts. For example, Asdal (2008) has written evocatively of the 'little tools' that link economic precepts to the practical valuations that civil servants and other functionaries have to attach to landscapes or amenities. In a related vein, Fourcade (2011) has examined international comparisons between the ways in which, for example, oil spills are attributed with an economic impact or cost. She highlights the complexity of the institutional arrangements through which values come to be assigned in apparently economically similar countries such as France and the USA. Though economic values are at stake, law courts may play as big a role as markets in arriving at binding valuations of ecological problems.

This kind of approach to the day-to-day practices of value ascription has given rise to a more general interest in the sociology of valuation as exemplified by the founding of the e-journal Valuation Studies (in 2013, see Helgesson and Muniesa 2013). They assert that the journal's raison d'être is 'that "valuation as a social practice" is a specific and interesting topic to study' (2013, 3). Here the focus is on studying more generally the social processes involved in performing valuations; as Dussauge et al put it: "The proposition [is] that we examine *all kinds of values* as upshots of practices …" (2015, 8, original emphasis).

Analysing valuations in the environmental arena

For the purposes of this chapter, directed at arguing for the study of (economic) valuation as a core concern of environmental social science, it is helpful to examine empirical issues around valuation in relation to two leading contemporary environmental issues. The first, and better known, concerns the attempt to put a price on climate policy options, to develop markets in carbon, to value carbon sinks, and to trade forgone emissions through the Clean Development Mechanism (CDM), Joint Implementation (JI), and associated strategies. The second case has been less discussed in this sense, but it is at least equally critical; it concerns practices of, and concepts for, the valuation of natural resources – especially in

relation to ecosystems-services assessments and attempts to "cash out" the value of biodiversity. In presenting this overview, I shall divide the analysis into four thematic sub-sections – the first two dealing with in-principle concerns and the latter pair with issues at the practical level.

Questioning the appropriateness of economic valuations

The first set of key questions is to do with the suitability of economising or implementing a market in environmental goods per se. The doubt is whether a market works in expressing the kinds of value that actors believe should be ascribed to the environment (at a philosophical level this has been a key concern publicised by Sandel, see his 2012). O'Neill had already made this point very starkly two decades ago (1993, 64) when he argued (against cost-benefit-type approaches to valuing environmental goods) that 'The defence of environmental goods requires reference not to preferences as they are, but to preferences as they ought to be'. His concern was that neo-classical economics turns on contingent preferences – people's measured preferences as they happen to be. These are taken as empirical inputs, as a statement of how things are, and then the argument is made that – given what we know about people's preferences – more should be done to protect the environment. But O'Neill is concerned about potential conflicts between preferences and what is good for the natural environment, and he is also worried about the changeability (one might say 'unreliability') and malleability of preferences. This anxiety is shared by many ecological economists who hope to identify scientific reasons why valuations of key environmental goods should be set on a different basis from most other, customary goods.

Responding to the Stern Review on the cost of climate change, columnist and campaigner George Monbiot made a similar point in the *New Left Review* in 2007:

> This methodology leads to a disastrous consequence, unintended but surely obvious. Stern's report shows that the dollar losses from failing to prevent a high degree of global warming outweigh the dollar savings arising from not taking action. It therefore makes economic sense to try to prevent runaway climate change. But what if the result had been different? What if he had discovered that the profits accruing from burning more fossil fuels exceeded the social cost of carbon? (2007, 106).

In effect, Monbiot observes that it is 'lucky' that the figures in the Stern Review worked out in favour of environmental interventions. It is logically possible that they might not have, and that it would be instrumentally rational to put up with extensive climate changes if – for example – the costs of action significantly exceeded the calculated price of adapting to or fixing the likely impacts.

Overall, the anxiety here is that, once the decision is made to express the gravity of environmental problems in economic terms, there is nowhere else to turn

if the financial calculation runs against you. If one accepts (however tentatively and unwillingly) that the value of ecosystems services should be expressed in monetary terms, then one is accepting that other monetary values can (potentially) exceed the value of ecosystems. Bees, for example, currently seem very valuable, and the value of the pollination services they provide has been used as a powerful resource in arguing for taking a precautionary line in recent policy debates over what to do about the possible toxic effects of neonicotinoid insecticides (see Juniper 2013, 105). However, if in a thought experiment it turned out that smart, robotic drones were able to do the job more effectively, then bees might lose the benefit of the pollination services they formerly supplied. If bees are valued primarily for the services they supply, when those services are no longer needed bees will see their value wiped out.

This conceptual or philosophical point is aggravated by the observation that prices are not as precise and robust as economic theory seems to presuppose. In the case of the Stern Review (as Jamieson 2014 carefully demonstrates) the argument over the review's conclusions moved from one about carbon/climate policies to one about the correct discount rate (the extent to which a sum now is preferred over the 'same' sum in the future). Change a few assumptions and the manner in which future harms are costed in today's money, and it can be made to appear overwhelmingly rational to act right away or, on the other hand, to do nearly nothing now and wait for solutions (cheaper, better batteries for example) to come along. Jamieson concludes that economics alone can resolve little about the right way to price carbon emissions because the answer will depend on how one values future wellbeing, and this is an ethical or political issue. If the critical and decisive part of the equation depends on – potentially irresolvable – questions about the correct discount rate, then one cannot easily delegate responsibility for environmental protection onto the market (Yearley 2009). Moreover, as occurred with the Stern Review, a lot of attention passes to clashes over the details of the calculation and away from the specifics of what climate policies to adopt or the societal consequences of environmental change.

How general is the applicability of economic valuations?

A related issue concerns the extent to which pricing, even if it is suitable for some environmental entities, is applicable to all classes of problems. Early debates here centred on environmental 'goods' for which there was neither a market nor an identifiable 'service'. Many of the knottiest examples came from the field of conservation and had to do with envisaging the value of endangered species or threatened habitats.

Some environmental attributes of this sort could indeed be thought of in economic terms and priced using familiar methodologies. For example, if tourists pay

(or invest resources) to visit a place known for scenic or dramatic views then one perhaps has a way of thinking about the value of the landscape to those people; its value is expressed through the amount of money and lost earnings they are willing to commit to visiting it. Similarly, if people now visit the Azores or New Zealand to engage in whale-watching then one can think about the visitor-value of the wildlife. Accordingly, conservation investments (in preserving habitat and so on) can be shown to be economically rational (or not) and one could even think of 'ecology investment' agencies comparing different wildlife sites and working out where best to get a conservation return for every dollar committed.

There remains, however, the unobserved or perhaps unattractive wildlife, and here the solution seemed to be to talk about 'existence value'. In other words, certain aspects of the environment were to be prized simply for their existence. The economic value of this could only be assessed by carrying out surveys or other price-estimating exercises. Researchers would have to attempt to gauge what people would notionally pay to ensure that species continued to exist or would notionally demand to be compensated for the species going extinct. Jacobs early on (1994) pointed out the drawbacks of such approaches, given apparent inconsistencies in the answers received and also the artificiality of the monetary values when people are asked about the price of something they have no experience of trading in, and in a market with only a make-believe existence.

Additionally, there have been related difficulties with attempts to be precise about the valuation of *all* aspects of ecosystem services. A formulation in terms of 'ecosystem services' came to be preferred to talking of environmental services because it appeared to offer a more specific account of the value delivered (see Mooney and Ehrlich 1997, 11-16). For instance, in the UK National Ecosystem Assessment (2011) services are divided into categories such as 'regulating' (for example regulating rainfall and water run-off) and 'supporting' (the above-mentioned case of the pollination efforts of insects, including bees). The aim here is clear: to be accurate about the kinds of service 'provided' so that a comprehensive, quantitative assessment of those services can be calculated and used in policy decisions. These are essentially accounting measures, designed to separate out the kinds of value delivered to us by natural processes. However, as in other areas of accountancy, there are difficulties about the allocation of services to particular headings and about the amount of interpretative flexibility that exists in the practical business of making classifications (for social studies of accountancy, see Quattrone 2012). To arrive at the 'real' value of ecosystem services, one requires a definitive list of the sub-types of services and confidence that items have not been double-counted or accidentally omitted. But given the breadth of interpretative flexibility in identifying these categories and assigning bits of the natural world to them, it is not clear that this 'real' valuation can be pinned down in practice.

The continuing salience of this type of problem in obtaining economic values of general utility is helpfully indicated by the way that aspects of the social and cultural value of biodiversity have recently been treated in the UK National Ecosystem Assessment.

The UK NEA was an exercise established in 2007 in response to the House of Commons Environmental Audit's recommendation that the UK Government ought to conduct a Millennium Ecosystem Assessment-type evaluation for the UK to 'enable the identification and development of effective policy responses to ecosystem service degradation' (as expressed on the NEA website[v]). In their *Synthesis of the Key Findings* (2011) the UK NEA attempted, among many other items, to address the religious and spiritual significance of UK ecosystems: this was one of the sub-types of service the natural environment was said to furnish. Their summary asserted that:

> Environmental settings play a positive role in religious practice and faith but more general evidence on their spiritual and religious role is limited.[vi] *Religious and spiritual goods are clearly linked to our existence need for <u>being</u>, but the extent to which religious encounters with specific environmental settings are synergistic satisfiers for value needs such as participation and identity resides in the character and qualities of belief*. The importance of ecosystems in religious terms had almost certainly increased in the post-war period in Britain, notwithstanding secularisation and the decline of conventional religious observance. There has, apparently, been an increase in the incidence of both pilgrimage and of religious retreats although it is extremely difficult to identify any quantitative measures of this trend. *It is extremely hard to pin-point evidence of particular landscapes or ecosystems being conducive to religious experiences* (2011, 82-83: italics added, underlining original).

The underlying point that is being made about associations between experiences of nature and some religious sentiments is clearly a reasonable one, and the reported difficulty in finding quantitative measures is understandable.

However, the commitment to an ecosystem services approach leads the NEA authors to offer a curious way of expressing their fundamental point; as cited above, they ask: are 'religious encounters with specific environmental settings … synergistic satisfiers for value needs'? This approach seems to be committed from the outset to reducing religious sentiments to other 'value needs', contrary to what actors themselves seems to feel about the character of religious encounters. Indeed, the subsequent reference (in the passage cited) to 'the character and qualities of belief' rather tends to concede the same point since it implicitly allows that the character of the beliefs *itself* has some explanatory force.

These difficulties in handling religious valuations indicate persistent, profound problems with the generalisability of the framework that requires all values to be

expressed in price or quasi-economic terms. On this view, everything that has a value at all must have a value that can be converted into an economic value. This leads analysts either to mis-characterise religious (and other cultural) values by reducing them to economic ones or not to regard them as values in the first place.

How are markets made?

While the first two points are about doubts and contests over the suitability of the entire exercise – the viability of the economistic 'paradigm' so to speak – there are additional problems that seem marginal but are in practice very consequential. These problems arise largely within the paradigm and have accordingly been highlighted by authors from *within* environmental and ecological economics as well as from outside.

One key, indicative issue is to do with the way in which markets are established. Perhaps the best known example here relates to the EU's Emissions Trading Scheme (ETS). The ETS was intended to bring about a reduction in greenhouse-gas releases from the EU by creating a European market in carbon emissions (chiefly to the atmosphere). Actors and institutions would only be able to make emissions for which they had allowances. Enterprises that managed to reduce their emissions would be able to sell surplus permits, leading the market to favour relatively low-carbon operations and steering the European economy in the correct direction. However, despite elaborate planning and a very large investment in building the apparatus for a market, the market failed in the sense that the price of carbon dwindled and stayed low so that it made little impact on firms' decisions and yielded little financial reward in terms of permit-sales for those adopting lower-carbon techniques.

The ETS was confronted with at least two sorts of problems. First, in the negotiations and haggling through which allowances were determined in the first place, too many permits were issued and firms' projections for the rate at which carbon allowances could reasonably be withdrawn from the system were too limited. Consequently, once the market was in operation few players had trouble acquiring sufficient allowances or adopting relatively cheap measures to stay within their allowances, and the market became otiose (Grubb 2013, 240-44). Moreover, the severe economic downturn from 2007/2008 meant that carbon emissions declined because industrial and commercial activity decreased. The carbon market could add little to this pressure and, in any case, governments were not keen to stifle any signs of economic growth that they could detect. There was an associated fear that carbon pricing might well lead to carbon-intensive industries moving their activities out of the ETS zone altogether, thus saving on permits while limiting Europe's economic well-being, but without reducing overall, global emissions since the carbon would be released in states that imposed no charges for carbon emissions.

Markets may also face design difficulties that lead to unintended incentives arising from the details of pricing mechanisms. Firms and countries have been willing to exploit such 'loopholes', leading to improper profits and the subversion of environmental objectives. Perhaps the best known case here involves a hydrofluorocarbon known as HFC-23[vii]. Since they contain no chlorine, HFCs do not damage the ozone layer but they can serve some of the uses formerly met by CFCs in refrigeration and fire-control. However, they turn out to be very potent greenhouse-gases; HFC-23 is well over ten thousand times as warming as carbon dioxide by weight. Under the Kyoto Protocol, signatory countries could earn credits through the Clean Development Mechanism for preventing greenhouse-gas emissions elsewhere in the world. In other words, rather than reducing greenhouse gases at home, countries could meet some of their targets by paying for the reduction of emissions in other countries (typically in developing economies). In 2007 a controversy arose when *Nature*, *New Scientist* and others reported that the CDM was being employed to pay for the destruction of HFC-23 where it was generated as a by-product from making other refrigerants in China, India and elsewhere. On the face of it, this seemed like a good idea. But the report suggested that something odd was going on since '"HFC 23 emitters can earn almost twice as much from the CDM credits as they can from selling refrigerant gases – by any measure a major distortion of the market," [wrote] Michael Wara of Stanford University, US, in the journal *Nature*' (*New Scientist* 9th February 2007)[viii].

The central irony was this. It costs relatively little to destroy HFC-23 molecules in a way agreed as safe, but this hydrofluorocarbon is such a powerful greenhouse gas that the credits for disposing of it are very high. Thus there is a potential economic incentive to generate the gas as a (supposed) 'by-product' simply to attract the credits. Businesses would effectively get paid to make it and then destroy it. Not only is this a foolish use of money, the purchase of these credits reduces the pressure to reduce carbon dioxide emissions in the North since the Northern country is already credited with having eliminated greenhouse gases (the HFC-23) – even if the production of that HFC-23 was only motivated by the existence of the CDM system (on other tensions to which economic transactions around these traded gases give rise, see Bailey et al 2001).

The publicity around this problem provoked changes to the detail of the credits available for HFC-23 destruction. But the problem of perverse incentives to produce gases that generate profits from their destruction rather than their use has persisted – as recently recorded by researchers from the Stockholm Environment Institute (Schneider and Kollmuss 2015) citing, among others, cases in Russia and Ukraine.[ix] More significantly still, this problem is not restricted to carbon markets; in free-market economies commercial actors will be motivated to follow the profits

offered within any system of incentives and will look for opportunities to 'game' the market – often resulting in the subversion of the supposed goals of the system.

The work behind pricing and selling

The final point to which to draw attention relates to the sociology of the practices that result in the assignment of prices, the determination of taxation levels, or in decisions to trade. In ideal – or idealised – markets, prices arise from the interactions of buyers and sellers. In this model, market participants are well informed, and operate with a shared rationale for conducting trading. But some key environmental markets are far from ideal in this sense.

Actors who are supposed to respond to price signals to steer their environmentally related behaviours may not be experienced or confident in their market responses. For example, it has been suggested that 'pilot' carbon markets in China were less successful than hoped partly because plant managers lacked enthusiasm for trading. It was also in part due to the fact that they were keen to work out what political leaders would like them to do (and then do it) rather than respond to market signals (see Lo 2016, 119). Managers were used to a system of political direction and found it hard to adapt, or to believe that political direction had really been suspended in favour of a market. In this case, organisational sociology and political science are as central as economics to understanding the phenomenon of behaviour in the market.

Similarly, the analysis by Asdal (2008) already mentioned above illustrates a related point. In her work on the 'Little Tools' that enable markets to function in particular organisational contexts, she highlights the administrative practices that allow prices to be attached to specific habitats or to emissions from particular power-plants. Typically, for example, examples of habitats need to be categorised into types and then ranked – by scientific civil servants or by consultants – before economic values can be attached to them and market disciplines applied. Again, and as illustrated by the case of the contested categorisation of peatbogs and their conservation value (Yearley 1989), the values ascribed in a market depend on these preceding tools and the order those tools create. Economic valuations are dependent upon other, earlier forms of evaluation.

Finally in this section, it should be noted that there is already a strong sense in which mainstream economics itself has moved away from dealing with ideal situations and has concentrated on psychological and even biological dimensions of economic behaviour. Through comparatively recent fields such as behavioural economics (Heukelom 2014) one could say that mainstream economics has become more inductively empirical. But in environmental policy initiatives such as the National Ecosystem Assessment case discussed above, where values are being

ascribed to cultural and spiritual benefits not by the actors themselves but by others on their behalf, it is plain that the values arrived at do not have the same kind of empirical warrant. The value-attributions do not arise from market interactions but from different kinds of professional practices altogether. These practices – from surveys through to professional judgements – are clearly a focus for sociological as well as economic investigation. This applies both because higher-level economic calculations may be based on inputs whose origin or original meaning is not really understood by the ultimate analyses, and because there is the possibility that actors are 'gaming' the valuations by attributing values that they hope will influence policy outcomes rather than by trying to assign the most indicative value they can.

Valuation as a key concern for environmental sociology

Given the spread and wide adoption of economists' versions of environmental value – within governments, firms and NGOs, within international organisations and funding agencies, and within professional training and graduate courses – it is apparent that economic valuation of the environment is now a key component of the landscape of environmental discourse and practice. This chapter has been designed to make a case for economic valuation being recognised as a core concern for the environmental social sciences. At a certain level, sociological studies of the environment have always acknowledged an economic dimension, notably when considering whether economic growth is inimical to environmental protection. But the focus of this chapter has been different: it has centred on the way in which economists have sought to assist the environmental cause by showing that environmental goods have economic value. As with Lord Stern's approach to climate change, the argument is that environmental economics can show that environmental protection, even major environmental reforms, are economically beneficial.

The analysis offered in this chapter has indicated how the idea of 'economisation' is central to understanding the ways in which economic discourse has been put forward as the authoritative and universal way of expressing the value of environmental goods and benefits. The paper has also highlighted the role of Barnesian performativity, in the sense that environmental actors have participated in rendering the environment a fit subject matter for the application of economic discourse. To think, for instance, of biodiversity and the benefits provided by the natural environment as 'ecosystems services' at all – as services to our way of life – is already to have economised them.

The paper has also sought to highlight specific empirical areas where the work of valuation is particularly contentious, and where social scientific insights are helpful in understanding the social processes by which valuations are arrived at. These insights matter both conceptually and practically, as has been shown by cases of

disputes about the applicability of pricing approaches, and by reports of gaming and malpractice within newly created markets in environmental goods. They also matter to a wide variety of actors, not just to government agencies and the regulators that handle the prices and markets, but to NGOs that worry about embracing environmental economics and to new firms and consultancies which aim to trade in carbon futures or carbon off-setting.

Finally, it is clear that other ways of valuing the environment strongly persist, whether that is in aesthetic or natural-history terms, in novel forms of citizen engagement with environmental options, or in forms of love and reverence for the environment that are hard to express in academic prose. The points made above about the importance of analysing practices for establishing the value of the environment apply in these cases too. There is, most likely, a very broad sociology of ways of valuing the environment – whether economically, aesthetically, scientifically or in other ways. But this chapter must content itself with a narrower aim – that of establishing economic valuations of the environment in all their various forms as a key focus for conceptual and empirical work in environmental social science.

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[i] There are several exceptions here, most of which will be returned to below but see Jacobs 1994 and O'Neill 1993 for early critical perspectives and Sandel 2012 for a very well known, though philosophical rather than empirical, assessment; there is also a growing sociological literature on practices of valuation, ranking and assessment (for example, around indexes and on-line voting and approval systems) which intersects with the points discussed below.

[ii] In the last decade it has become more common to speak of the services provided as 'ecosystem services' (see Silvertown 2015); the intended implications of using this terminology will be examined later in this chapter. For now, environmental services and ecosystem services can be treated as more or less synonymous.

[iii] These interviews were conducted as part of the EU-funded project "Environmental Sustainability and Institutional Innovation in Europe" which ran from 1 April 1994 to 31 July 1996; the UK project team was comprised of Steven Yearley and John Forrester. It is perhaps worth pointing out here that the Secretary of State is the normal title for the leading minister within a UK government ministry.

[iv] In this context, the term 'financialisation' from economic sociology deserves a mention since it draws attention to the ways in which the dominance of mobile, global financial markets has influenced economic trends and the autonomy of political institutions; for an example, see van der Zwan 2014.

[v] Consulted on 29 June 2017 http://uknea.unep-wcmc.org/About/tabid/56/Default.aspx .

[vi] This headline assertion is scored with a '4' in the report indicating that the claim is 'Speculative' characterised by 'low agreement based on limited evidence' (2011, 67).

[vii] the naming of CFCs and hydrofluorocarbons is complicated but HFC-23 is a simple molecule; essentially a methane molecule with three of the hydrogen atoms replaced by fluorine: CHF_3.

[viii] see https://www.newscientist.com/article/dn11155-kyoto-protocol-loophole-has-cost-6-billion/ consulted on 29 June 2017.

[ix] see http://www.theguardian.com/environment/2015/aug/24/kyoto-protocols-carbon-credit-scheme-increased-emissions-by-600m-tonnes consulted on 29 June 2017.